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PATENT SPECIFICATION

1,044,922

DRAWINGS ATTACHED

1,044,922

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Int. Cl.:—B 24 c, B 64 c

COMPLETE SPECIFICATION

Flying Device with Double Fuselage Arrangement

We, JUNKERS FLUGZEUG-UND MOTORENWERKE AKTIENGESELLSCHAFT of 1, Franz-Joseph-Strasse, 8, Muenchen, 13, Germany; a German body corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a flying device having a twin fuselage arrangement, preferably for space travel and use in air.

In the technology of space travel the problem arises of returning space vehicles undamaged to earth. It has therefore been proposed for such flying vehicles to be fitted with retractable wings by means of which they may be caused to land as so-called space gliders like sail planes. According to a further proposal before re-entry into the earth's atmosphere a gliding sail in the manner of a kite is ejected. The sail may consist of a metallic membrane which despite optical permeability aerodynamically constitutes a substantially impermeable surface.

The present invention consists in a flying device comprising two fuselages with adjacent front ends and rearwardly diverging longitudinal axes, a wing being disposed between the fuselages and being secured thereto, the wing being arranged and constructed in such a manner as to permit angular movement of the fuselages towards and away from each other.

It will be appreciated that a reduction of surface load per unit area, necessary for the landing approach and improvement of lift and resistance ratio can be obtained by increasing the angle between the fuselages.

As the wing, a membrane may be used which adjusts itself in accordance with the tensile stresses. In this way no bending moments are introduced into the fuselages. Furthermore the wing is preferably so dimensioned that the tensile forces of the wing are conducted tangentially into the fuselage skin.

The invention may be realised moreover by means of a folding wing having surfaces which in themselves are rigid, and which are hingedly interconnected at the folding edge and connected hingedly with both fuselages. Therefore in this case no bending moments are introduced into the fuselage either.

In both cases it is possible therefore for the fuselages to be of substantially lighter construction than is the case with wings rigidly anchored to the fuselage. For reasons of strength the fuselages are expediently given circular cross-sections. In accordance with the shape of the flying device the fuselages may have a tapering shape. For reasons of simple manufacture the two fuselage nacelles however are preferably of cylindrical construction.

The invention provides the possibility for the load per unit surface area and the lift and resistance ratio of the wings to be adapted to the given flight requirements by the fact that the angle between the fuselages is variable by horizontal swing about axes at right angles relative to the fuselage axes.

In the case of horizontal swinging of a membrane wing, the membrane will be supported partly against the fuselage wall, so that the tensile forces continue to be conducted tangentially into the fuselage wall. If in this manner the angle between the twin fuselage arrangement is increased, then the membrane will become increasingly arcuate in an upwardly direction. In order to avoid this aerodynamically unfavourable effect, it is possible for the fuselages in accordance with a further development of the invention to be rotated simultaneously with the horizontal swing, so that the membrane at its fixing point is wound around the fuselages at both of its sides. The simultaneous horizontal swing and rotation of the fuselages may be obtained by mounting the fuselages for hinged movement about axes extending obliquely relative to the fuselage axes. With such a movement the fuselages are in fact not swung in a strictly true plane but

in practice however, owing to the aerodynamic counter forces and possibly by additional control manoevres it can be achieved that no change of the flight position occurs, so that the flying device with the described change of angle between its fuselages maintains its direction in space.

In the case of a folding wing, the latter on swinging together the two fuselages forms a large lateral tail unit having an acute lip angle which in high speed flight substantially improves the stability of course. For slow speed flight the lip angle of the twin fuselage arrangement is increased by increasing the angle between the fuselages, and hence the aerodynamically effective surface of the wings can be increased by a greater or lesser extent depending upon flight conditions.

The invention will be further described by way of example with reference to the accompanying drawings in which:—

Figs. 1 and 2 are perspective views of a flying device according to the invention showing the disposition of membrane wings;

Fig. 3 is a plan view of the flying device of Figs. 1 and 2;

Fig. 4 is a fragmentary exploded perspective view of a flying device having membrane wings as in Figs. 1, 2 and 3;

Fig. 5 is a plan view of the arrangement of Fig. 4 with parts joined together;

Fig. 6 is a fragmentary exploded perspective view of an alternative flying device having membrane wings as in Figs. 1, 2 and 3;

Fig. 7 is a plan view of the arrangement of Fig. 6 with the parts joined together;

Figs. 8 and 9 are perspective views of a flying device having folding wings between two fuselages;

Figs. 10 and 11 are cross sections of the flying device of Figs. 8 and 9 showing different positions of the folding wings; and

Fig. 12 shows a mechanism for spreading the fuselages of the flying device of Figs 8 to 11.

In the drawings like parts are denoted by like reference numerals.

Referring to Figs. 1, 2 and 3 frusto-conical fuselages 1 and 2 are filled substantially by fuel tanks and on their rear end have retro-jets 3, 4. At the nose of the flying device there is a cabin 5. Between the fuselages 1, 2 a flexible wing 6 is provided which is secured to the fuselages at its sides. In the case of space vehicles and high performance aircraft, the wings 6 expediently consist of a metallic membrane, otherwise however the membrane may also be of a textile fabric. Figs. 1, 2 and 3 show the flying device with a maximum angle of divergence between the fuselages and thus with the maximum effective wing area for landing. Fig. 3 indicates in broken lines how the angle between the fuselages and hence the aerodynamically effective area of the flexible wing may be reduced for high speed flight.

Figs. 4 and 5 and also Figs. 6 and 7 illustrate two examples for horizontally swinging the fuselages. In both cases the flying device has a separate cabin portion 5^1 or 5^{11} to which two fuselages 1^1, 2^1 or 1^{11}, 2^{11} are hingedly connected. In addition to the closing together or spreading apart of the fuselages, a rolling movement about the longitudinal fuselage axes should take place, so that the wing membranes are rolled up about or unrolled from the fuselage portions, the membranes being omitted from Figs. 4 to 7 for the sake of clarity.

In accordance with Figs. 4 and 5 the fuselages 1^1 and 2^1 are hingedly connected to the cabin portion 5^1 by means of hinge lugs 6 which engage hinge portions 10*a*, 10*b* on the cabin portion 5^1. The rotary movement of the fuselages about their longitudinal axes is caused by two servo motors 7*a*, 7*b*, pinions 8*a*, 8*b* of which cause bearing elements 9*a*, 9*b* to rotate with the hinge portions 10*a*, 10*b*. The spreading of the fuselage portions is effected by actuating a telescopic booster 11, which preferably operates hydraulically. The booster 11 is connected by means of hinges 12*a*, 12*b* to axles 13*a*, 13*b* which in turn are rotatably connected to the fuselages 1^1, 2^1. The booster 11 simultaneously serves to brace the fuselage structure.

According to Figs. 6 and 7 the coupled spreading and rotation of the fuselages 1^{11} and 2^{11} is effected by diagonal pivotal axes 14*a*, 14*b* on the cabin portion 5^{11}, which are inclined both relative to the longitudinal axis and the vertical axis of the flying device and journalled to the fuselages 1^{11} and 2^{11} by means of the hinge parts 15*a*, 15*b*. The telescopic booster 16 corresponds to the arrangement according to Fig. 4. Owing to the inclined position of the axes 14*a*, 14*b* there is created not only a horizontal swinging but also a rotation of the fuselage portions 1^{11} and 2^{11}.

The construction may be still simpler if the membrane is to be spread out only once per flight before landing (e.g. on re-entry of a space vehicle into the atmosphere), i.e. dispensing with retraction during flight. For this solution it is necessary only for the two fuselages to be mutually horizontally swung about their axes at right angles relative to their longitudinal axes. The fact that the lift takes place with greater load per surface area will in many cases just have to be accepted, because in this flight phase a minimum resistance is required.

The flying device shows a good rolling and lateral stability and without an adjusting mechanism also possesses substantial technical advantages which are summarized below:

1. The wing is stressed only by tension—there is no transfer of bending moment.

2. The wing does not conduct any bending moments into the fuselage arrangement.

3. The tension introduced into the fuselages may take place tangentially, which is static-

ally simpler and facilitates construction.

4. The wing is relatively light.

5. The wing comprises a single wall membrane, so that compared with a profiled hollow wing the transfer of forces and thermal stresses between top skin and lower skin is eliminated.

6. The heat conducting wing membrane is adjusted to medium temperature between pressure and suction side. The temperature stressing of the membrane on the pressure side occurring on re-entry is higher by about 500°C than on the suction side and is hence lower than it would be if a covering were provided on the pressure side.

7. An acutely temperature sensitive leading edge of the wing is eliminated.

Figs. 8 and 9 show a flying device according to the invention having substantially inflexible folding wings in two inclined views and in Fig. 10 and 11 in two diagrammatic cross-sections.

The cylindrical fuselages 21 and 22 are substantially filled by fuel tanks and at their rear ends have retro-jets 23, 24. At the nose of the flying device there is a cabin 25.

Combined horizontal and vertical rudder surfaces 26, 27 are rigidly mounted on the outer sides of the fuselages. Between the fuselages 21, 22 a folding wing is mounted, the two cuneiform surfaces 28, 29 of the wing being interconnected by means of hinges 30 and hingedly connected to the fuselages 21, 22 by means of the hinges 31, 32 (see Fig. 10).

Fig. 12 diagrammatically shows a mechanism for spreading apart the two fuselages 21, 22. The two fuselages 21, 22 are fixed to the cabin portion 25 by means of two parallel axles 33, 34 which extend vertically. A telescopic booster 36 arranged at the stern, and which is preferably hydraulically actuated and corresponds to the booster 11 in accordance with Fig. 4, spreads the fuselages into the required spread position.

Fig. 10 illustrates the degree of folding of the wing for low speed flight and Fig. 11 for high speed flight. The hinged mounting of the folding wing on the fuselages 21, 22 is so effected that the wing surfaces are directed substantially tangential relative to the respective fuselage walls. At the mounting point of the hinges 31, 32, tensile forces are conducted into the fuselages and extend predominantly in the direction of the fuselage skin. The hinges 31, 32 are arranged somewhat outside the fuselage walls in order to enable the wing to assume both limit positions. The hinges are preferably so fixed that the forces in the spread open position are conducted accurately tangential into the fuselages, as a precaution against considerable loading.

The construction described with a folding wing has a good stability around all flight axes and also without an adjusting device has substantial technical advantages which are summarized below:

1. The wing conducts none or only slight bending moments into the fuselage bodies.

2. The introduction of force may be tangential, which is statically simpler and leads to light constructions.

3. The wing has a lower weight than a rigid unsupported wing connected to a central fuselage.

WHAT WE CLAIM IS:—

1. A flying device comprising two fuselages with adjacent front ends and rearwardly diverging longitudinal axes, a wing being disposed between the fuselages and being secured thereto, the wing being arranged and constructed in such a manner as to permit angular movement of the fuselages towards and away from each other.

2. A flying device as claimed in claim 1, wherein means are provided for varying the angle between the two fuselages.

3. A flying device as claimed in claim 1 or 2, wherein the wing is flexible.

4. A flying device as claimed in claim 1 or 2, wherein the wing is a folding wing formed of two substantially inflexible members.

5. A flying device as claimed in any one of claims 1 to 4, whrein the wing at the fixing points on the fuselages extends substantially tangentially relative to the fuselage walls.

6. A flying device as claimed in claim 3, comprising means for rotating the fuselages in the mutually opposite directions.

7. A flying device as claimed in claim 6, wherein the rotation and simultaneous spreading of the fuselages is about axes inclined relative to the fuselage axes.

8. A flying device having a twin fuselage arrangement and substantially as described with reference to and as illustrated in Figs. 1 to 7 of the accompanying drawings.

9. A flying device having a twin fuselage arrangement and substantially as described with reference to and as illustrated in Figs. 8 to 11 of the accompanying drawings.

POTTS & CO.

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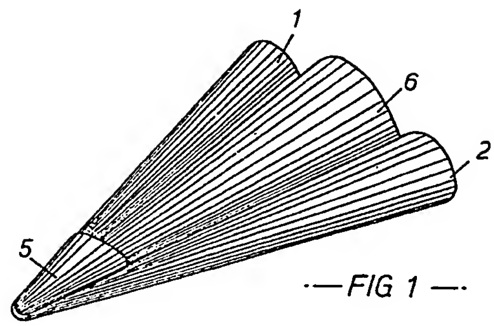
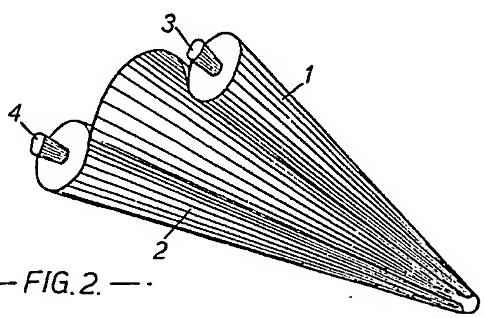
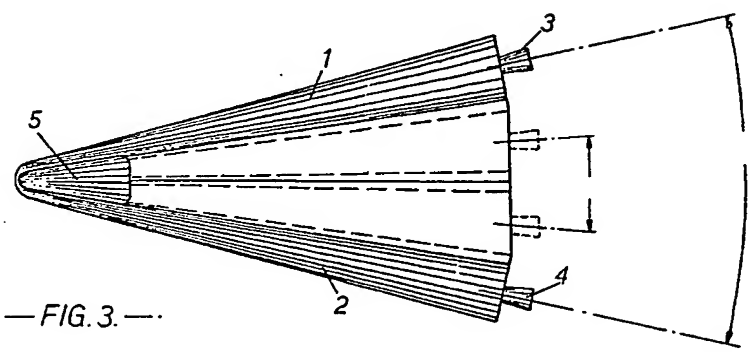


—FIG 1—



—FIG. 2.—



—FIG. 3.—

FIG. 4.

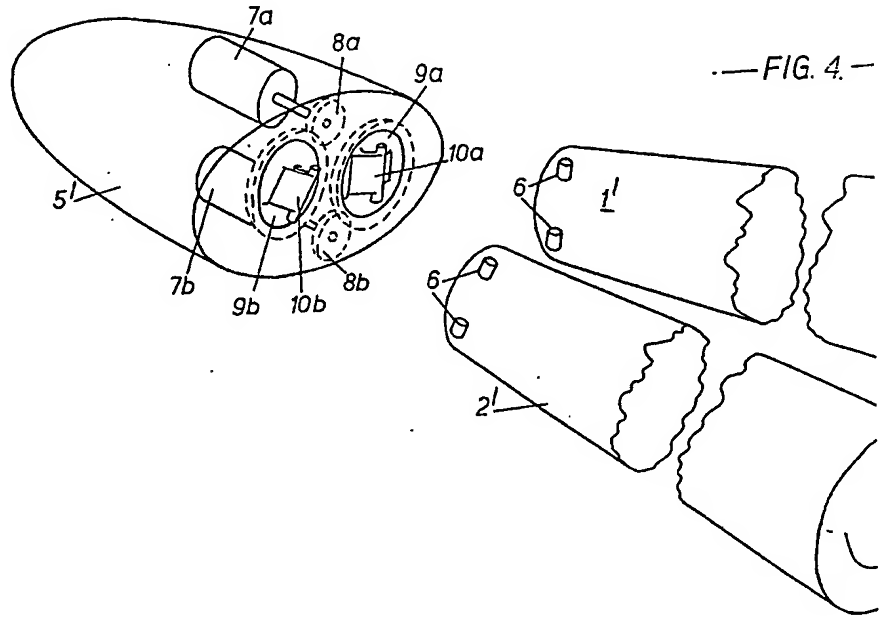
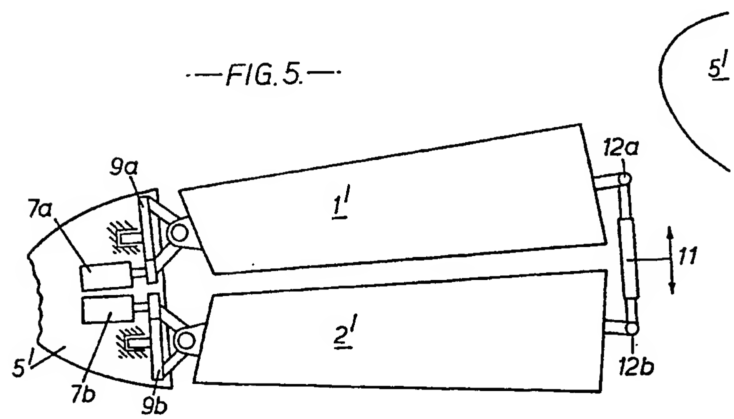


FIG. 5.



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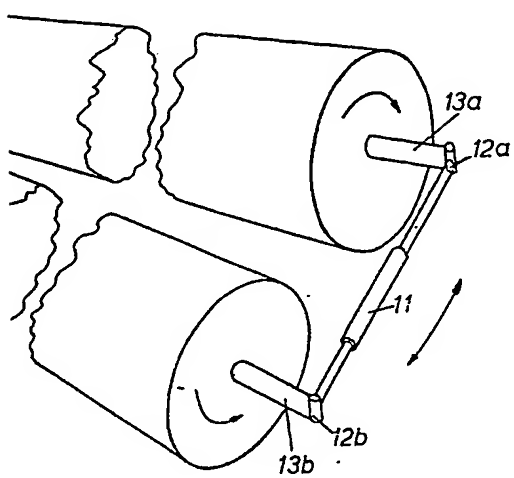
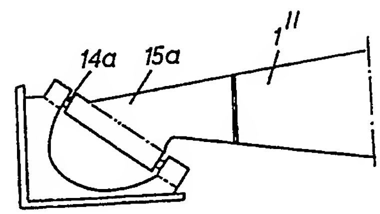
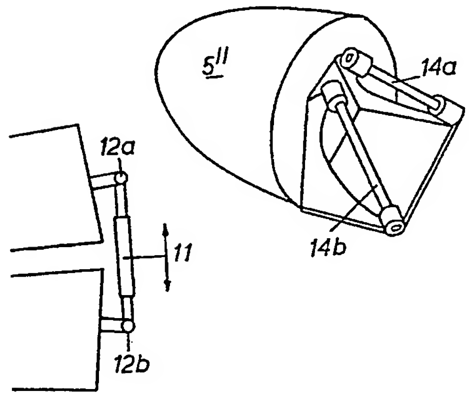
—FIG. 4.—

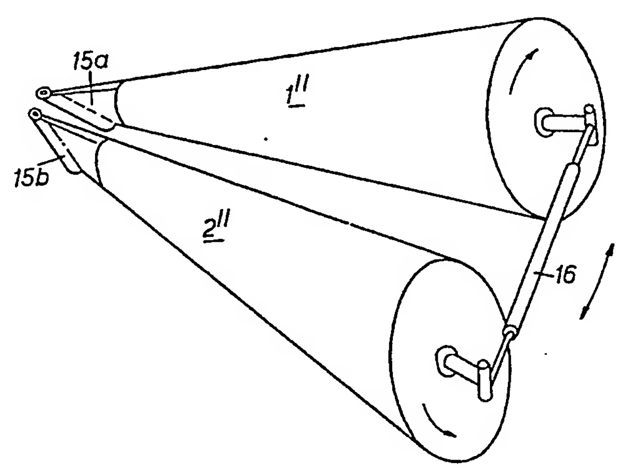


—FIG. 7.—





—FIG. 6.—



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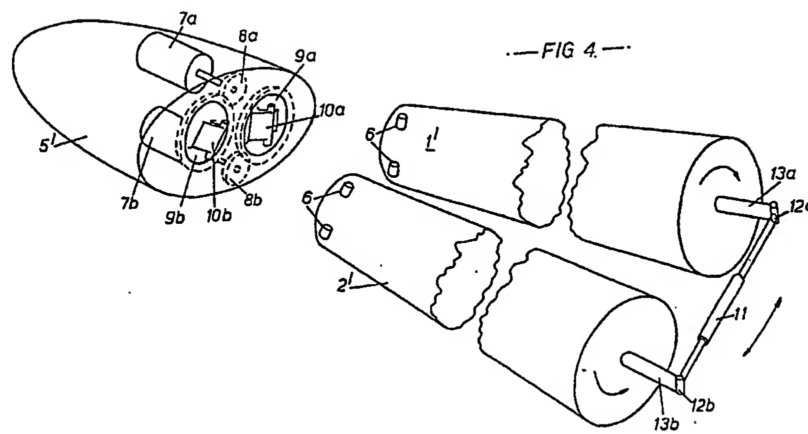
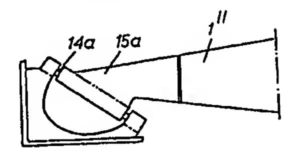
Sheet 2

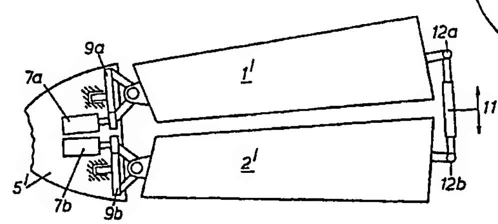
—FIG 4.—



—FIG. 7.—



—FIG. 5.—



—FIG. 6.—

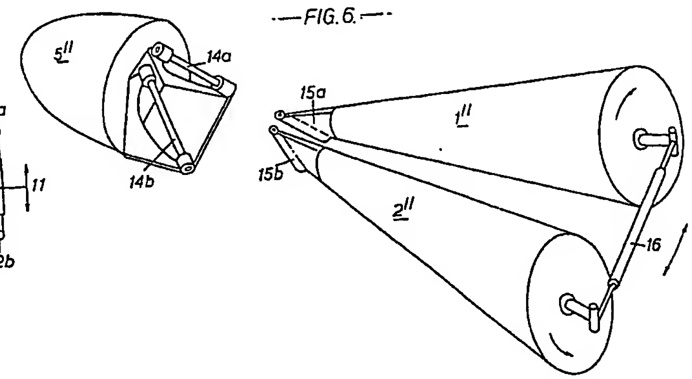
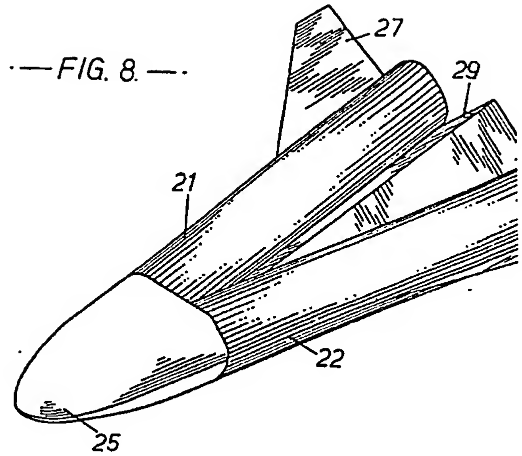


FIG. 8.



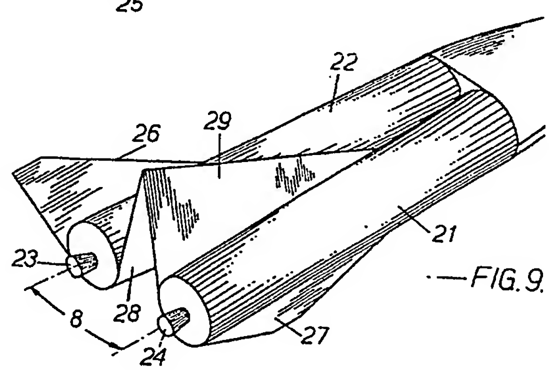


FIG. 9.

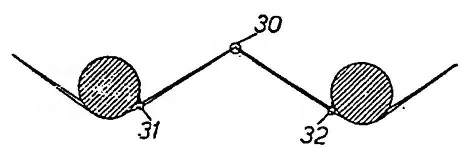


FIG. 10.

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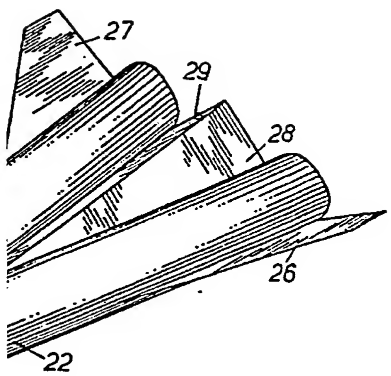
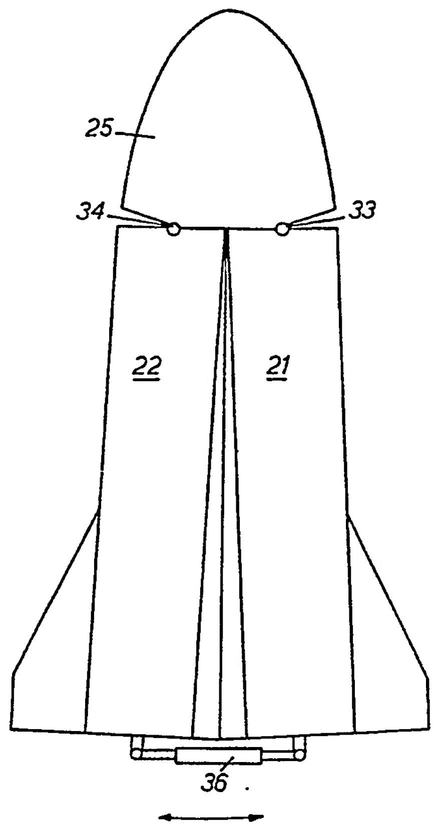
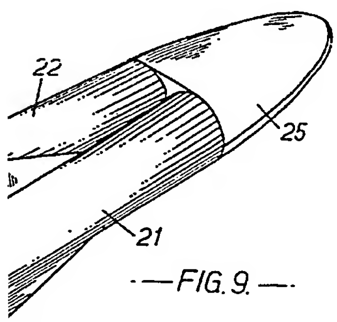


— FIG. 12. —





— FIG. 9. —

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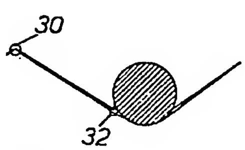

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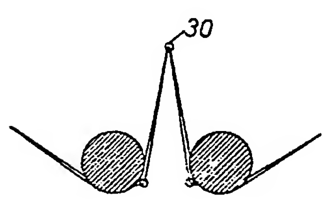
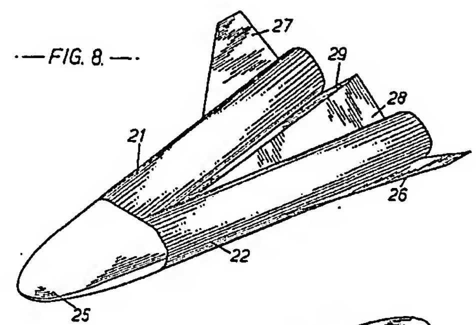


— FIG. 11. —

FIG. 8.



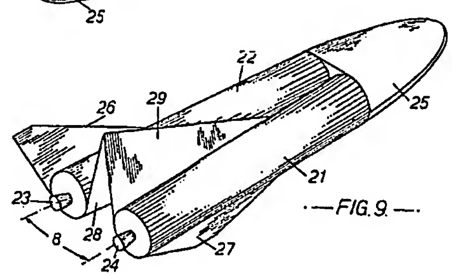


FIG. 9.

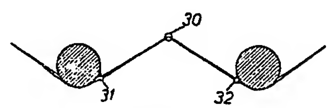
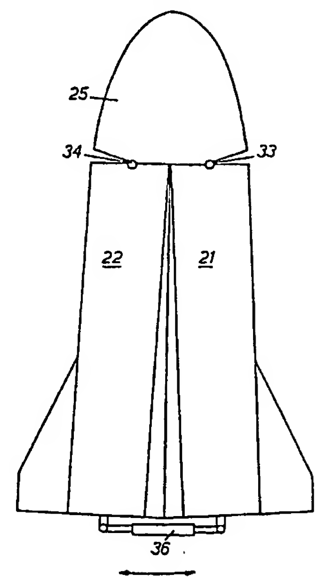


FIG. 10.

FIG. 12.



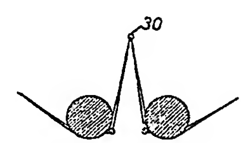


FIG. 11.